Marka-Sweep 1500-C

KAY ELECTRIC CO.

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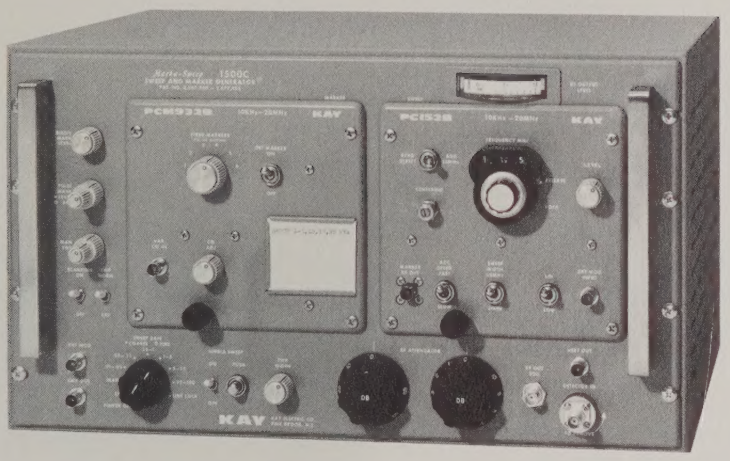

MARKA-SWEEP
1500-C

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SECTION I

GENERAL INFORMATION

1.1 INTRODUCTION:

The Model 1500C is a basic rack unit which accepts individual plug-in units to develop swept frequencies and markers. The basic unit contains a variable sawtooth generator, frequency marker trigger circuits, RF output circuits with precision rotary attenuators, calibrated output meter, accurate plug-in detector and the electronically regulated power supply.

Continuously variable sweep repetition rates between .01 and 750 Hz are provided, permitting selection of an optimum rate for each application. The slower rates are useful for aligning high - Q circuits, or can be locked to the line frequency for general operation. A sawtooth voltage, synchronized with the swept RF output, is available at a separate output terminal and may be used to drive the X-axis amplifiers of an oscilloscope. A blanking circuit is included to turn off the RF output during retrace time.

Manual control of the RF sweep, which is synchronized with the sawtooth output voltage, permits point-by-point control of the frequency display. The response of the most demanding circuits can be checked or recorded using this method.

1.2 SPECIFICATIONS:

SWEEP MODES:	.01 - 750 Hz continuously variable 60 Hz Line Lock Manual External Single Sweep
SWEEP DIRECTION:	Hi-Lo; Lo-Hi
SWEEP TO RETRACE SYMMETRY:	Normally 4:1, adjustable 4:1 to 1:4
SWEEP OUTPUT:	8 V p-p, sawtooth, symmetrical around 0 volts.
OUTPUT IMPEDANCE:	50Ω 75Ω optional
FREQUENCY RANGE:	To 4 GHz
ATTENUATORS:	0-60 db in 10 db steps 0-10 db in 10 db steps
DETECTOR:	Plug-in type
MARKERS:	Pulse type or birdie-pip type at customer specified frequencies, Marker amplitude continuously variable to 8 V (pulse type) or 8 V p-p (birdie type).
POWER INPUT:	115 V ± 10%, 50-60 Hz.

SECTION II

OPERATION

2.1 INTRODUCTION:

The operating controls on the basic rack unit have a direct relationship to those on the sweep and marker plug-ins. Individual operating instructions are provided for the plug-in units and should be referred to before proceeding.

2.2 OPERATING CONTROLS

A. FRONT PANEL

POWER OFF/SWEEP RATE FINE: (Inner Knob-Sweep Rate Switch)	Vernier control of sweep repetition rate, OFF position located at the maximum CCW position.
SWEEP RATE COARSE: (Outer Knob-Sweep Rate Switch)	Selects the sweep repetition range or SWEEP MODE (External, or Line Lock).
SINGLE SWEEP ON/OFF:	Selects either continuous or single sweep operation. The ON position the single sweep circuits are activated. The direction of the sweep is determined by the +/- single sweep switch located on the rear apron.
SINGLE SWEEP PUSH SWITCH:	This switch is pushed to start the single sweep. The sweep will commence when the switch is pushed and continue until it reaches the end of its excursion as long as the switch is held down. The sweep retrace occurs only after the switch has been released.
SWEEP WIDTH:	This control provides for continuous variation of the sweep width.
RF ATTENUATORS:	Controls the RF output level.
BLANKING ON/OFF SWITCH:	Selects either blanked or unblanked operation.
SWEEP NORMAL/REVERSE:	Selects the direction of the sweep trace. In the NORMAL position the sweep direction is from high to low; in the REVERSE position the sweep direction is from low to high.
SWEEP AUTO/MAN:	Selects either automatic sweep at the selected rep. rate or manual sweep.
MANUAL SWEEP: (Dual Concentric)	Inner (coarse), outer (fine). Provides control of the swept output when the SWEEP RATE control is in the MANUAL position.

PULSE MARKER:	Inner (ADJ), outer (LEVEL). The ADJ control determines the firing point of the markers. The LEVEL control determines the amplitude of the pules.

B. FRONT PANEL CONNECTORS:

EXT MOD:	Provides an input for an externally generated sweep voltage. This voltage should be ± 6 V (around ground) for full sweep excursion from DC to approximately 2 KHz.
SWEEP OUTPUT:	A sawtooth voltage, synchronized with the sweeping output, is available at this jack. This sawtooth is normally used to drive the horizontal circuits of an oscilloscope.
RF OUT:	All swept frequencies are available at this jack.
VERT OUT:	The detected signal, plus MARKERS, is available at this jack. This output is normally connected to the vertical deflection circuits of an oscilloscope.
DETECTOR IN:	If the swept signal is beyond the frequency range of the oscilloscope, it may be applied to the 1500C detector. This detector may be removed for added convenience.

C. INTERNAL CONTROLS:

+150 V ADJ:	Used to adjust for +150 V output from the high voltage supply.
+30 V ADJ:	Adjusts the +30 V power supply.
-30 V ADJ:	Adjusts the +30 V power supply.
SINGLE SWEEP START POSITION:	Determines the starting point of the Single Sweep. May need readjustment if the polarity is changed or if the sweep symmetry is readjusted.
LINE LOCK ADJ:	Used to lock the sweep generator to the 60 Hz line frequency. May need readjustment if the sweep symmetry is readjusted.
SWEEP SYMMETRY:	Adjusts the ratio of sweep to retrace time. The Line Lock and Single Sweep start position may need readjustment after changing the Sweep Symmetry control.

2.3 OPERATION:

A. Typical interconnection of equipment is shown in Fig. 2.2. The use of coaxial cable, properly terminated, is suggested to avoid pick-up of extraneous signals, furnish a good ground, and provide the proper impedance match. All leads should be kept as short as possible.

B. Set the SWEEP RATE controls to the desired MODE: VAR., LINE LOCK, etc.

C. Adjust the SWEEP WIDTH control for a convenient display.

D. Adjust the remaining controls such as BLANKING, SWEEP NOR/REV, SWEEP AUTO/MAN as desired.

E. The RF amplitude is controlled by the RF level control on the head and the two rotary attenuators on the 1500C.

F. For manual operation, place the SWEEP AUTO/MAN in the MAN position and vary the MANUAL SWEEP pot to produce frequency sweeps.

G. Single sweep operation is accomplished by placing the Single Sweep ON/OFF switch in the ON position and pushing the Single Sweep push button to start the sweep. The sweep will return to its origin only when the button is released. The sweep repetition, width and RF output amplitude are all controlled as in normal operation.

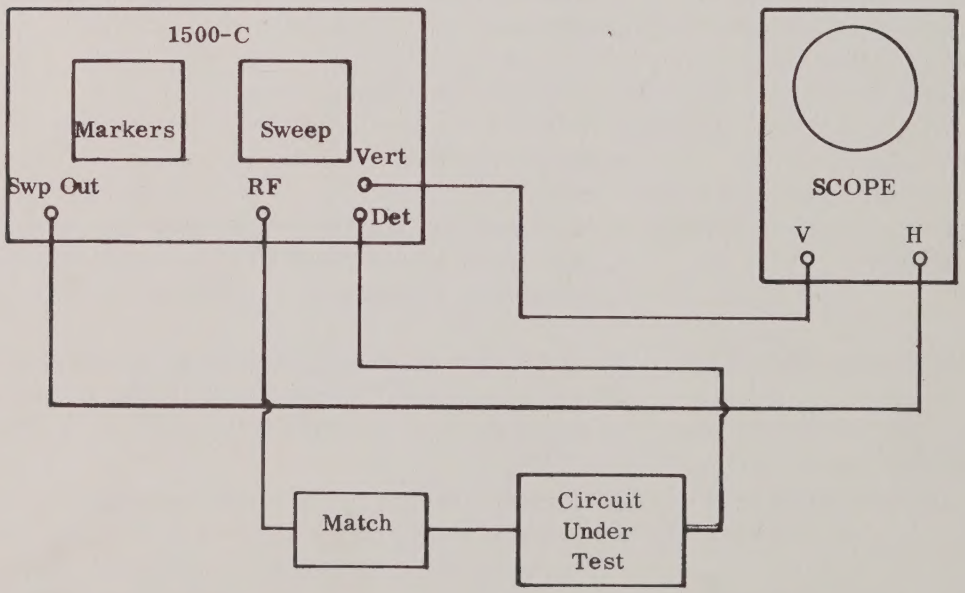


FIG. 2.2 TYPICAL INTERCONNECTION OF EQUIPMENT

SECTION III

CIRCUIT DESCRIPTION

3.1 INTRODUCTION:

This section contains a general description of the functions of the basic 1500C rack unit. This information is provided to aid the operator in maintaining or troubleshooting his instrument.

3.2 CIRCUIT DESCRIPTION:

A. Major Circuits

The 1500C consists of the following basic circuits: sawtooth voltage generator, mark amplifier circuits, power supplies, rotary attenuators, and plug-in detector.

1. Sawtooth Voltage Generator - When RATE SELECTOR is in the LINE LOCK position, an AC sinewave is applied to Sync Lock ckt. Q207 which generates a trigger pulse to fire sawtooth generator Q208 & Q209. Transistors Q210 thru Q213 accept the output of Q208 & Q209 (a regular squarewave) and develop it into a sawtooth waveform. The final sawtooth voltage waveform is determined by Q214 & Q215 which also contain the controls for sweep width and zero symmetry. Blanking Amplifier Q216 accepts a sample of the squarewave from Q208 & Q209, amplifiers it and feeds it to the sweep section where it is used to blank the RF oscillators during the oscilloscope retrace time.

   When operating the 1500 in the variable repetition positions, the frequency of the generator is determined by fixed capacitance and the SWEEP RATE potentiometer R7.

   Manual operation is accomplished by placing the sweep AUTO/MAN in the MAN position, this removes the sweep generator circuits, and substitutes resistor network R260 thru R263 and the MAN sweep pot (R8). Varying R8 causes a voltage change which is seen at Q215. This varying voltage, at a rate determined by the operator, is then fed to the RF oscillator in the sweep head.

2. Mark Amplifier Circuits

   a. Pulse Mark Amp. - The pulse marker generated in the marker head is fed to Schmidt Trigger generator Q201 which fires when the voltage reaches sufficient amplitude. The resultant trigger pulse is used to activate pulse generator multivibrator Q202 & Q203. The output of the multivibrator is fed to Emitter Follower Q204 where it is shaped and then passed to the 1500C output circuits.

   b. Birdie Marker Amplifier - The birdie markers are developed in the marker head and passed to Q205 and Q206 in the 1500C rack where they are amplified and the mark level adjusted by R3. The markers are then passed to 1500C output circuits.

3. Removable Detector - This circuit functions as a conventional half-wave detector composed of C301, D301 and R301. Normally, the RF output is coupled to the circuit under test and back into the DET INPUT. The VERT OUT is connected to the VERT INPUT on the scope and the SWP OUT is connected to the HORIZ INPUT. The detector may be removed from the 1500C and used externally if desired.

4. Power Supplies - The three power supply circuits are electronically regulated and short circuit protected. The input requirements are: 105 - 130 V A/C, 50 - 60 Hz. The power supply provides three output voltages: +150, 100 ma. max., +30, and -30 V at 300 ma. max.. The AC ripple component is less than 1 mv. The primary windings of transformer T-1 may be connected in series for operation from a 230 V source.

5. Rotary Attenuators - The rotary attenuators provide up to 70 db of attenuation in 1 db steps. Additional control of the RF output is provided by means of an RF level control on many of the RF sweep generator plug-in heads.

SECTION IV

MAINTENANCE

4.1 INTRODUCTION:

This section contains instructions for a periodic check of the instrument's performance (which may be accomplished without removing the instrument from its cabinet). The information provided in the alignment procedure will enable the operator to maintain the unit's optimum performance.

4.2 CHECK OUT PROCEDURE:

A. EQUIPMENT REQUIRED:

1. Oscilloscope (Tektronix 503 or equiv.)

NOTE: Marker Plug-in and RF plug-in units must be fully seated in their receptacles to close the AC interlocks.

B. SWEEP CIRCUITS

1. Provide a connection between the SWP OUT jack and the vertical input of the scope.
2. Place the SWEEP RATE switch in LINE LOCK.
3. Check for a sweep symmetry of 4:1 (unless specified otherwise).
4. See that the sawtooth voltage is locked to 60 Hz.
5. Check to see that the sawtooth is centered around zero volts. The amplitude of the signal should be $\pm$ 4 volts pk/pk.
6. Switch to each SWEEP RATE position and see that the repetition rate range is obtained by varying the FINE control.
7. Place the SWEEP AUTO/MAN switch in the MAN position. See that the MAN SWEEP FINE control varies the trace approximately 10% more than the sawtooth amplitude. The MAN SWEEP COARSE control should vary the trace in a ratio of approx. 20:1 vs the FINE MAN SWEEP control.
8. Place the SWEEP RATE switch in the EXT. position. Provide a +6 V DC input to the EXT MOD jack. +4 volts should be seen at the SWEEP OUT jack. Check for an -4 volt output by utilizing a -6 V DC input.

C. SINGLE SWEEP

1. Adjust the 1500C for a sweep rate of approximately .25 Hz.
2. Place the SINGLE SWEEP ON/OFF switch in the ON position.
3. Depress the SINGLE SWEEP push switch and see that the sweep makes one excursion and returns to its starting point when switch is released.

D. BLANKING

1. Place the BLANKING ON/OFF switch in the ON position.
2. See that the RF is blanked during retrace time.

E. BIRDIE MARKERS

1. Provide an external CW oscillator input to the VAR CW IN connector on the plug-in marker head. (CW frequency should be within the range of the sweep plug-in).
2. Adjust the BIRDIE MARKER LEVEL control so that a marker is visible on the trace.
3. A marker of approximately 8 volts p/p should be obtained.

F. PULSE MARKERS

1. Place the INT MARKER ON/OFF switch (on plug-in head) in the OFF position.
2. Adjust the BIRDIE MARK LEVEL for minimum level.
3. Set the SWEEP RATE to LINE LOCK.
4. Set the PULSE MARK ADJ control approximately 10^{O} from maximum clockwise.
5. Set the PULSE MARK LEVEL to midrange.
6. See that the specified markers are visible. The LEVEL and ADJ controls may be used for optimum performance.
7. Check marker operation at the various sweep rates, widths, and directions.

G. INTERNAL MARKERS

1. Provide a cable between the RF OUT jack and the DETECTOR IN jack.
2. Adjust the PULSE MARK LEVEL for minimum output.
3. Place the INT MARKER ON/OFF switch in the ON position. Adjust PULSE MARKER ADJ control.
4. Check to see that internal markers appear as sharp absorptions in the RF output.

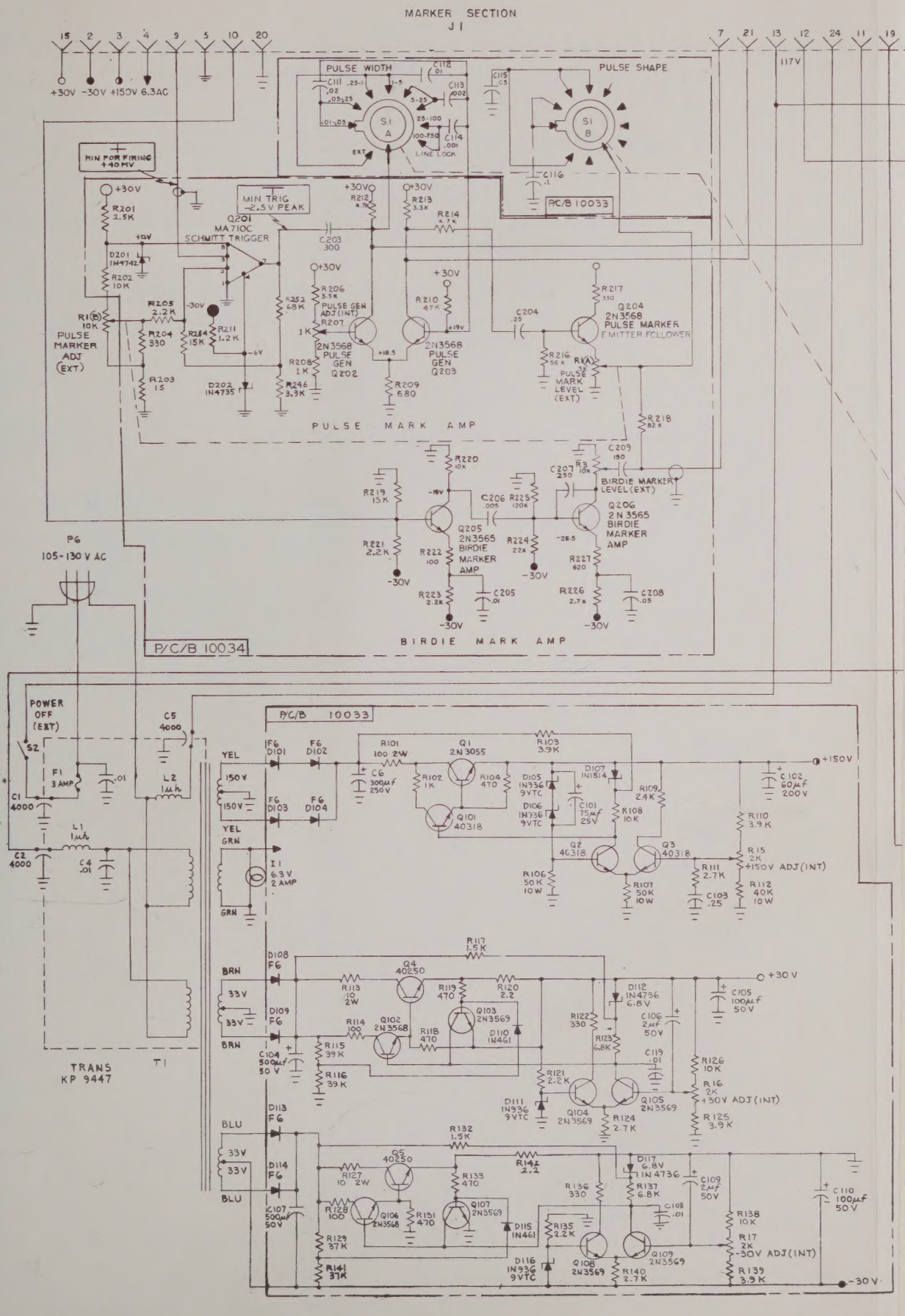
4.3 ALIGNMENT PROCEDURE:

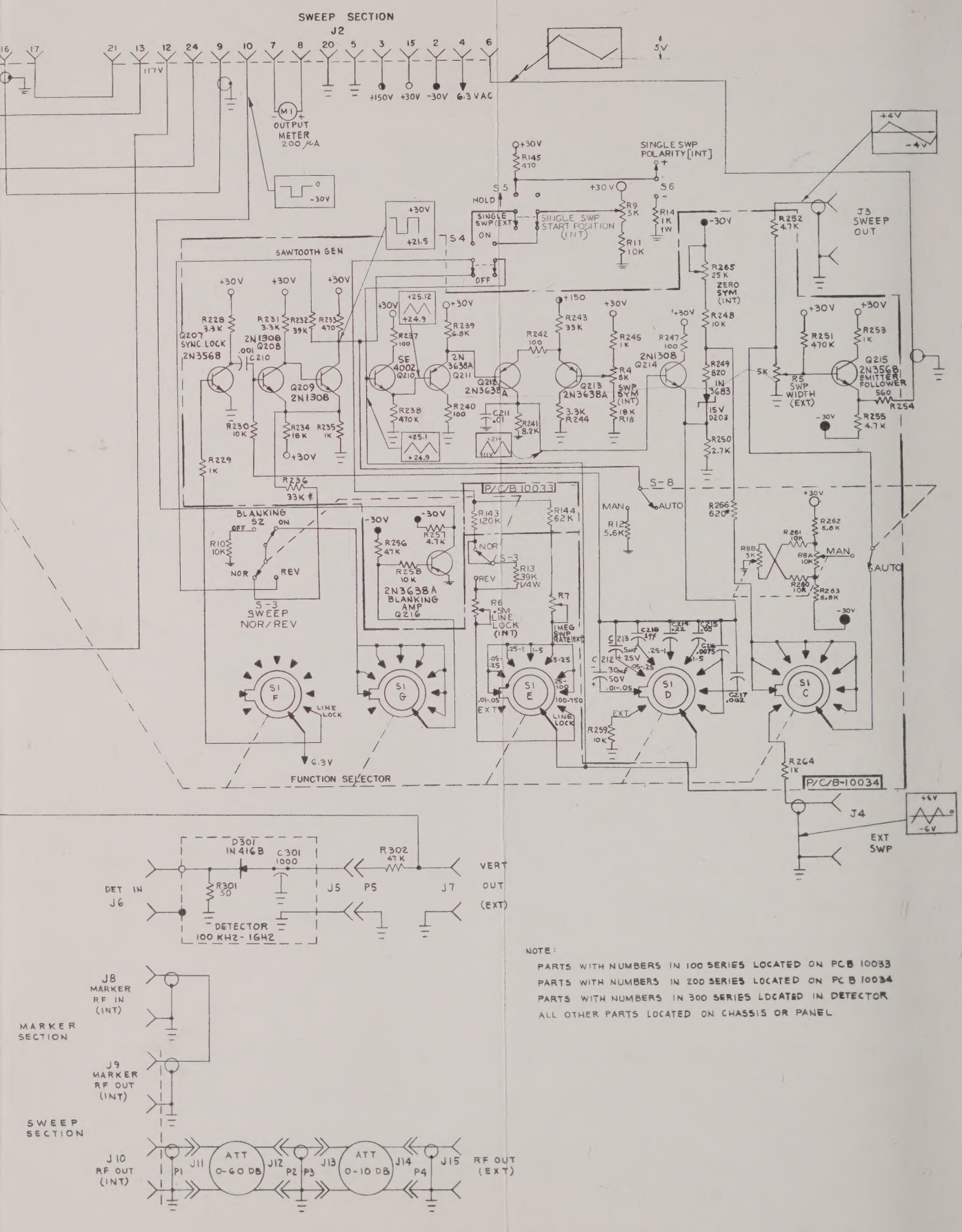
A. EQUIPMENT NECESSARY

1. VTVM
2. Oscilloscope (Tektronix 503 or equiv.)
3. Variable Line Voltage Transformer (105-130 volts)
4. DC Power Supply

B. PRELIMINARY

1. Set all pots on rear apron to midrange.
2. Set all pots on PC Board 10034 to midrange.
3. Set the SINGLE SWEEP polarity switch to +.
4. Place the front panel switches in the following positions:
   a. BLANKING ON/OFF - ON
   b. SWEEP NOR/REV - NOR
   c. SINGLE SWEEP ON/OFF - OFF
5. With the power switch OFF, connect the 1500C to the variable transformer. Set the line voltage to 115V.
6. Ascertain that the RF and sweep plug-ins are firmly seated in their respective receptacles.


MARKER SECTION
J1
15 2 3 4 9 5 10 20
+30V -30V +150V 6.3AC
7 21 13 12 24 11 19
117V
PULSE WIDTH
PULSE SHAPE
S1 A
S1 B
EXT
LINE LOCK
MIN FOR FIRING +40 MV
MIN TRIG -2.5V PEAK
Q201 MA710C SCHMITT TRIGGER
P/C/B 10033
PULSE MARKER ADJ (EXT)
PULSE GEN ADJ (INT)
2N3568 PULSE GEN Q202
2N3568 PULSE GEN Q203
Q204 2N3568 PULSE MARKER EMITTER FOLLOWER
PULSE MARK LEVEL (EXT)
PULSE MARK AMP
BIRDIE MARKER LEVEL (EXT)
Q205 2N3565 BIRDIE MARKER AMP
Q206 2N3565 BIRDIE MARKER AMP
BIRDIE MARK AMP
P6
105-130 V AC
P/C/B 10034
POWER OFF (EXT)
S2
F1 3 AMP
L2 1mh
L1 1mh
I1 6.3 V 2 AMP
TRANS KP 9447
T1
P/C/B 10033
Q1 2N3055
Q101 40318
Q2 40318
Q3 40318
+150V ADJ(INT)
Q4 40250
Q102 2N3568
Q103 2N3569
Q104 2N3569
Q105 2N3569
+30V ADJ(INT)
Q5 40250
Q106 2N3568
Q107 2N3569
Q108 2N3569
Q109 2N3569
-30V ADJ(INT)
+150V
+30V
-30V



NOTE:

PARTS WITH NUMBERS IN 100 SERIES LOCATED ON PC B 10033
PARTS WITH NUMBERS IN 200 SERIES LOCATED ON PC B 10034
PARTS WITH NUMBERS IN 300 SERIES LOCATED IN DETECTOR
ALL OTHER PARTS LOCATED ON CHASSIS OR PANEL

SCHEMATIC, MAIN RACK UNIT, MARKA-SWEEP 1500-C DWG. #D9964J